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Production Traits of Tsigai Sheep in Slovakia

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Abstract

The Tsigai belongs to a group of sheep breeds raised in many countries. Despite its considerable popularity, the origin of this breed has not yet been fully elucidated. The name "Tsigai" was first mentioned in the literature in 1781, when Sulzer (cited by Ogrizek, 1948) [19] reported that the indigenous Tsigai sheep was raised in Dacia and Transylvania and was valued for its high-quality, short wool. Some authors, including Ditescu and Kuleshov (cited by Ogrizek, 1948) [19], have suggested that the Tsigai originated in Asia Minor. Based on analyses of mitochondrial DNA (mtDNA) sequences, Hiendleder *et al.* (2002, cited by Straka, 2022 [23]) concluded that domestic sheep originated from two mouflon subspecies, supporting the hypothesis of a polyphyletic origin of domestic sheep.

Based on the results of contemporary genetic analyses, Charlotte *et al*. (2022) demonstrated that the domestic sheep (Ovis aries) originated from the Asian mouflon (Ovis gmelini), from which the argali and other mouflon lineages also descended.

Keywords: Tsigai, Mouflon, Asia Minor, Mesopotamia

Introduction

Although sheep populations are declining and their importance is no longer as substantial as it once was, sheep farming remains an important component of the livestock sector in many countries. Across the European Union, the sheep population decreased by 12.2% compared with 2015 (https://link.europa.eu/6gDkR).

The Tsigai belongs to a group of sheep breeds raised in numerous countries. It should be emphasised at the outset that this breed is not suited to hilly and mountainous pastures. It can be successfully reared at elevations of up to 800 m above sea level. The biostatic conformation of the breed does not provide sufficient static and dynamic stability on steeper and higher-altitude terrain.

Despite its considerable popularity, the origin of the Tsigai has not yet been fully elucidated. On the contrary, opinions regarding its origin are highly contradictory. The Tsigai is not unique in this respect, as the origins of many other sheep breeds also remain uncertain. The name "Tsigai" was first mentioned in the literature in 1781, when Sulzer (cited by Ogrizek, 1948) [19] reported that the indigenous Tsigai sheep was raised in Dacia and Transylvania and was valued for its high-quality, short wool. Some authors, including Ditescu and Kuleshov (cited by Ogrizek, 1948) [19], have suggested that the Tsigai originated in Asia Minor.

In his comprehensive monograph on Slovak breeds of domestic animals, the Slovak author Straka (2022) [23] stated that the

Tsigai originated in the Balkans and that it is a very old sheep breed characterised by black pigmentation of the head and legs. A Balkan origin of the Tsigai was also reported by Horak *et al*. (2012) [5].

Mioč *et al*. (2011) [16] stated that the Tsigai belongs to the group of the oldest sheep breeds, although its origin has yet to be conclusively established. According to some opinions (Ulmanski, 1922, cited by Mioč *et al*., 2011 [16]), the Tsigai developed through a process of genetic improvement in the territories of Greece and Asia Minor. From these regions, it subsequently reached the Iberian Peninsula, where it contributed to the final development of Merino sheep. The influence of the Tsigai on the development of Merino sheep was also discussed by Ivanov as early as 1935 (cited by Mitić, 1984) [17]. According to this author, the Tsigai is similar to the Merino sheep in terms of its constitution and the fundamental characteristics of its wool.

Falck discussed the origin of sheep as early as 1931. According to this author, only true wild sheep could be regarded as the ancestors of domestic sheep. The most important, and probably the oldest, centre of sheep domestication was the region extending from Mesopotamia to Turkmenistan. Archaeological excavations near Anau revealed skeletal remains of polled sheep, estimated to date from approximately 6000 BC. The sheep represented by these skeletal remains were most likely related to the ancestors of the argali, from which domestic sheep subsequently developed.

Kadipski and Zahariev (1977) considered the Tsigai to have descended from the argali, a wild sheep inhabiting the south-western region of the Caspian Sea. From this region, the breed spread westwards. It became particularly well established in the countries of the Balkan Peninsula and Central Europe and eventually reached the southern regions of Russia.

Nica *et al*. (1959) [18] reported that sheep bone remains were discovered in Asia Minor, in the area surrounding the ancient city of Miletus. This ancient city was situated at the mouth of the Meander River on the eastern coast of the Aegean Sea. Its ruins are now located several kilometres from the village of Balat, approximately 4 km from the Aegean coast. The remains were estimated to be approximately 3,000 years old. The authors suggested that the Tsigai descended from the steppe urial (Ovis vignei arkar), which also had a form adapted to forest habitats.

In Bulgaria, two Tsigai types are regarded as national breeds: the Stara Planina Tsigai and the Rhodope Tsigai (Jordanov *et al*., 2017) [8]. Petrov (1928) stated that the ancestors of domestic sheep were mouflons, namely: (a) Ovis musimon, (b) Ovis orientalis, and (c) Ovis vignei.

The Tsigai is included in the World Watch List for Domestic Animal Diversity for sheep and goats (Horak and Treznerova, 2010) [6]. According to these authors, three Tsigai types can be distinguished: (a) sheep with a black head and black legs, found in Slovakia, Hungary, Bulgaria, and Serbia; (b) the white Tsigai, found in Russia; and (c) sheep with other colour patterns, such as the red or coffee-coloured head characteristic of some Romanian populations.

Maksimov *et al*. (Максимов Г.В. *et al*., 2018) stated that the Tsigai is highly suitable for crossbreeding with other breeds and is frequently used in breeding programmes in Russia. According to these authors, the Tsigai is traditionally characterised by a white coat.

Photo 1: Tsigai sheep in Russia (Maksimov *et al*., 2028)

Regarding the milk production of Tsigai sheep in Russia, Maksimov *et al*. (2018) reported a milk yield of 50–55 kg. This quantity is obtained after the lambs have ceased suckling. Neither the duration of the suckling period nor the total length of lactation was specified. The milk fat content ranges from 7.5 to 8.0%. Regarding the reproductive performance of the Russian Tsigai, the authors stated that ewes usually give birth to one or two lambs. Admittedly, this is a rather imprecise definition. The body weight of the Russian Tsigai is lower than that of Tsigai sheep raised in Central Europe, with adult ewes weighing 42–44 kg.

In a study of litter type and lamb birth weight involving 80 lambings, Urošević *et al*. (2023) [24] recorded 28 singleton female lambs (35%) and 32 singleton male lambs (49%). Twin births occurred in 20 cases, accounting for 25% of all lambings. Of the total number of twin births, two involved male twin pairs, representing 10% of twin births and 2.5% of all lambings. Female twin pairs were recorded in 11 cases, accounting for 55% of twin births and 13.7% of all lambings. Mixed-sex twin pairs represented 37% of all twin births and 8.75% of all lambings.

Mekić *et al*. (2007) [14] reported that, over a 180-day lactation period, Tsigai ewes produce between 50 and 150 kg of milk, whereas the milk yield of elite animals may reach 150–200 kg.

Horak *et al*. (2014) [4], describing Tsigai sheep in the Czech Republic, noted the existence of two types: (a) the entirely white Tsigai and (b) the Tsigai with a black head and black legs. The prolificacy rate is approximately 150%, while milk production ranges from 100 to 120 litres per lactation.

The Tsigai belongs to the group of large-framed sheep breeds with combined production traits. Its breeding objectives are weighted as follows: 50% towards milk production, 40% towards meat production, 5% towards wool density and quality, and the remaining 5% towards reproductive performance (https://www.agrimedia.ro/articole/tigaia-cu-cap-negru-de-teleorman-omologata).

Belić (1984) reported that the height at the withers ranged from 60 to 75 cm in ewes and from 70 to 85 cm in rams. The body weight ranged from 50 to 65 kg in ewes and from 70 to 100 kg in rams. Belić (1951) [1] emphasised that the Tsigai is characterised by good reproductive performance. In a study conducted on a single flock of Tsigai sheep, the author found that prolificacy ranged from 126.3% to 150.7%. High prolificacy rates of up to 150% have also been reported by certain Romanian authors (https://www.gazetadeagrucultura.info/animale/ovine-caprine/19334-rasele-romanesti-de-ovine.html).

According to Milosavljević (1964) [15], the Tsigai exhibits good reproductive performance, with more than 20% of ewes giving birth to twins. The author also reported an average milk yield of 90–100 litres per lactation.

Jordanov *et al*. (2017) [8] reported that the Stara Planina Tsigai produces 82–90 litres of milk per lactation, including 46–50 litres during the suckling period. The prolificacy rate of this Tsigai type ranges from 106% to 110%. The Rhodope Tsigai has a prolificacy rate of 105–110% and produces 80–85 litres of milk per lactation.

The lactation period in Tsigai sheep lasts from 160 to 200 days, during which milk yield ranges from 79 to 90 kg (Nica *et al*., 1959) [18]. Tsigai sheep raised in hilly regions produce 20–25% less milk than those reared in lowland areas.

Petrović *et al*. (2013) [21] reported that the prolificacy of Tsigai sheep ranges from 120% to 150%. During a 180-day lactation period, ewes produce 110–150 litres of milk. Adult females weigh 60–70 kg, whereas rams weigh 80–120 kg. Voia (2005) [25] stated that several Tsigai types are present in Romania and that their milk yield varies from 100 to 150 litres per lactation. Regarding reproductive characteristics, the author reported that oestrus occurs in 90–98% of ewes, while the conception rate ranges from 92% to 95%.

Marković *et al*. (2020) [13] described the Tsigai as a large-framed sheep breed. The height at the withers ranges from 60 to 76 cm in ewes and from 70 to 85 cm in rams. The body weight of adult ewes ranges from 70 to 75 kg, whereas adult rams weigh 110–120 kg. Milk yield during a lactation period of approximately 180 days ranges from 50 to 150 litres.

In his account of sheep production in Hungary, Wellmann (1932) [27] stated that the Tsigai originated in Asia Minor. In terms of body size, it was classified among sheep breeds slightly smaller than those of medium size. The author described the head and legs as brown or greyish-black and reported an annual milk yield of 50–60 kg.

Historical data from 1932 indicate that the Tsigai was not always a large-framed breed. In their description of sheep production in Czechoslovakia, Macalik and Križenecky reported that the body weight of Tsigai sheep was approximately 35 kg. The height at the withers was approximately 63 cm in rams and 58 cm in ewes. Interestingly, the authors did not mention black pigmentation as a characteristic of this breed. They described the Tsigai as a white sheep whose face and legs gradually acquired a dark-brown colour with advancing age. The authors reported a relatively high milk yield of 135–140 kg, although the duration of the lactation period was not specified.

Photo 2: A Tsigai phenotype that is no longer observed today. The legs are light-coloured (white), and the lower jaw is white, whereas the upper jaw, nasal bridge, and the part of the skull above the stop and around the eyes are dark brown. Photograph taken in 1932

The Tsigai, like many other sheep breeds, descends from ancestral populations that developed in the East. The argali is not considered an ancestor of domestic sheep. As early as 1860, L. J. Fitzinger stated that all hypotheses proposing the descent of domestic sheep from the argali—also referred to as the arkal or arkhar—were incorrect. Although he was, naturally, unable to conduct mitochondrial or cytogenetic analyses, he reached this conclusion on the basis of morphological and anatomical differences between domestic sheep, mouflons, and argali. His principal argument concerned differences in the number of caudal vertebrae. In most sheep breeds, with the exception of fat-tailed sheep, the number of caudal vertebrae is 3–4, whereas mouflons have 15–22.

Straka (2022) [23] reported that sheep were first domesticated between 11,000 and 9,000 BC in Mesopotamia. Domestic sheep originated from wild Asian sheep (Ovis orientalis).

Based on analyses of mitochondrial DNA (mtDNA) sequences, Hiendleder *et al*. (2002, cited by Straka, 2022 [23]) concluded that domestic sheep originated from two mouflon subspecies, thereby supporting the hypothesis of a polyphyletic origin of domestic sheep.

Based on the results of contemporary genetic analyses, Charlotte *et al*. (2022) demonstrated that the domestic sheep (Ovis aries) descended from the Asian mouflon (Ovis gmelini), which also represents the ancestral lineage from which argali and other mouflons originated.

Slovakia

Sheep farming in the territory of present-day Slovakia dates back to ancient times. Domestic sheep were already present in this region during the Late Neolithic, the final phase of the Neolithic period, between approximately 4500 and 3200 BC. Sheep were raised by virtually all the peoples who inhabited the territory of Slovakia, including the Celts, Avars, and Slavs. Evidence that these peoples practised sheep husbandry is derived primarily from archaeological artefacts. The earliest written document confirming the existence of organised sheep farming in Slovakia dates from 1151. It refers to sheep-rearing facilities or sheepfolds (ovile) and to shepherds or sheep keepers (Pastores ovilum) (Kulla, 2017, cited by Straka, 2022 [23]).

Sheep farming intensified considerably following the arrival and migration of the Vlach and Slavic populations. These groups settled in areas of the Carpathians that were suitable for livestock production, particularly sheep husbandry. Over time, sheep farming gradually expanded from mountainous regions into lower and more level areas. Sheep became an important economic resource. Shearing and wool production acquired particular significance, as wool represented an essential raw material for the manufacture of high-quality textiles in the Habsburg Monarchy by 1784.

Merino sheep were also raised. In 1783, a total of 500 Merino sheep were imported from Spain. This population was supplemented in 1785 by 144 rams and eight ewes of the Spanish Merino, as well as 20 rams and 98 ewes of the Paduan Merino (Merino Padovano) (Makovický and Margetín, 2016a, cited by Straka, 2022 [23]). The Paduan Merino is an Italian Merino breed developed by crossing Spanish Merino sheep with local Italian breeds.

In his study of Slovak history from the arrival of the Slavs until 1526, Kučera (2008) [10] noted, among other developments, that substantial migrations of ethnic groups from the Romanian part of the Carpathians to the Slovak

Carpathians occurred in the late fifteenth and early sixteenth centuries. These migrants were Vlachs who moved ahead of the advancing Ottoman forces. They were pastoralists and brought their livestock with them, most commonly sheep and goats. They settled in the south-eastern regions of the Slovak Carpathians, including areas situated at elevations of 1,000 m or more above sea level. Such environmental conditions did not present a major difficulty, as they were experienced livestock keepers accustomed to a pastoral way of life.

Interestingly, because they belonged to the Orthodox Christian faith, they were not required to pay a tithe to the Catholic Church. However, they were obliged to pay a twentieth, known as the vigesima, to the feudal lord or landowner on whose property they resided.

The declining trend in the Slovak sheep population was observed relatively early. In 1910, Slovakia had approximately 1,290,000 sheep. Only ten years later, in 1920, the population had decreased to 600,000, while by 1933 it had fallen further to 332,963 animals (Kulla, 2017, cited by Straka, 2022 [23]).

Photo 3: Slovak Tsigai (photo: M. Dukes)

According to the breeding standard applied in Slovakia, the body weight of Tsigai ewes ranges from 50 to 55 kg, while the breeding objective is a body weight of at least 55 kg. The standard body weight of rams ranges from 70 to 85 kg, whereas the breeding objective is 85 kg or more (https://zchok.sk/) [28].

With regard to milk production, the breed standard specifies a yield of 120–140 litres per lactation, while the breeding objective is 180 litres or more. During the suckling period, the standard requires a ewe to produce 80–90 litres of milk, whereas the breeding objective is 120 litres or more. The standard duration of the suckling period is 150 days. The milk should contain 5.1–6.4% protein and 6.5–9.0% fat, while the lactose content should range from 4.4% to 5.4%.

The standard also stipulates a minimum wool yield of 3.0 kg per ewe and 5.0 kg per ram.

Zigo *et al*. (2022) [26] reported that, in Slovak Tsigai sheep, the conception rate over a five-year period from 2014 to 2018 ranged from 88.5% to 94.4%, while prolificacy ranged from 130.4% to 137.5%. The breeding objective for prolificacy is 155%, whereas the breed standard specifies a prolificacy rate of 130%. According to the authors, milk yield reached 125 litres, while the most productive flocks produced up to 150 litres per ewe. Individual ewes producing as much as 200 litres of milk were also recorded.

Straka (2022) [23] reported that the monitoring of five breeding flocks comprising a total of 6,375 ewes between 2000 and 2008 revealed an average milk yield of 89.13 litres. The highest flock average was 104.49 litres, while the maximum individual milk yield reached 268.2 litres. With regard to reproductive performance, the monitoring of 8,315 ewes revealed an average litter size of 1.273 lambs per ewe (Margetín *et al*., 2009, cited by Straka, 2022 [23]).

In the best-performing flocks in Slovakia, prolificacy may reach as high as 150%.

Materials and Methods

For the analysis of the productive traits of Tsigai sheep in Slovakia, official data published by the Slovak Association of Sheep and Goat Breeders, based in Banská Bystrica, were used.

Results

The declining trend in sheep numbers recorded across European Union countries is also evident in Slovakia.

Table 1: Number of female Tsigai sheep in Slovakia (https://zchok.sk/) [28]

No	*Year*	*n*	*Relative to 2003 (%)*
1	2003	13.130	100
2	2004	12.728	96,9
3	2005	12.589	95,9
4	2006	12.234	93,2
5	2007	12.491	95,1
6	2008	12.381	94,3
7	2009	11.400	86,9
8	2010	11.440	87,1
9	2011	10.602	80,7
10	2012	10.450	79,6
11	2013	9.471	72,1
12	2014	7.277	55,4
13	2015	6.203	47,2
14	2016	5.507	41,9
15	2017	5.983	45,6
16	2018	5.530	42,1
17	2019	5.661	43,1

Based on the data presented in the table, it is evident that the number of female Tsigai sheep declined over the 17-year period from 2003 to 2019. By 2019, their number had fallen to 43.1% of the initial population recorded in 2003. With regard to reproductive performance, the results obtained from the ten best-performing flocks in 2021, 2022, and 2023 are presented.

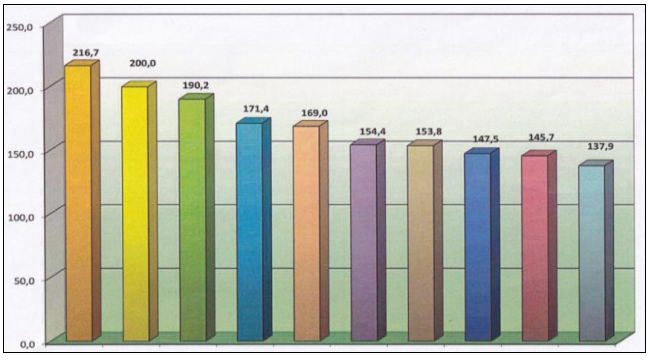

Fig 1: Prolificacy rate per ewe lambing in the ten best-performing flocks in 2021 (https://zchok.sk/) [28]

The data presented in the figure indicate that the first five flocks exhibited exceptionally high prolificacy rates. The maximum value of 216.7% and the minimum value of 137.9% demonstrate the high reproductive potential of Tsigai ewes. The following figure presents the results obtained for the ten best-performing flocks in 2022.

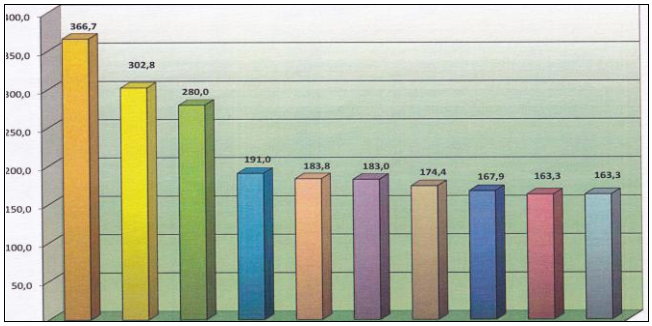

Fig 2: Prolificacy rate per ewe lambing in the ten best-performing flocks in 2022 (https://zchok.sk/) [28]

In 2022, the highest prolificacy rate per ewe lambed was recorded in the same flock as in the previous year; however, the rate increased to 366.7%. A marked increase in prolificacy was observed in 2022 compared with 2021. Whereas the tenth-ranked flock recorded a prolificacy rate of 137.9% in 2021, the corresponding rate in the tenth-ranked flock increased to 163.3% in 2022.

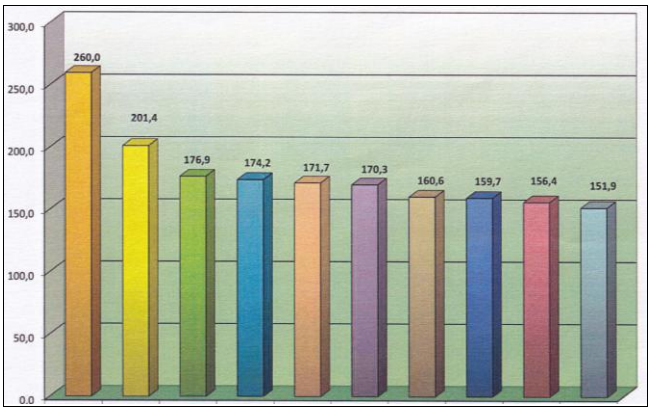

Fig 3: Prolificacy rate per ewe lambed in the ten best-performing flocks in 2023 (https://zchok.sk/) [28]

Interestingly, prolificacy declined markedly in 2023 compared with the previous year, although it remained somewhat higher than in 2021. The best-performing flock recorded a prolificacy rate of 260.0% per ewe lambed, whereas the tenth-ranked flock achieved 151.9%. Despite being lower than the results recorded in 2022, these values clearly indicate that the reproductive performance of Tsigai sheep in Slovakia remains at a high level.

The results of the prolificacy analysis conducted on a large sample in 2022 and 2023 are presented in the following table.

Table 2: Prolificacy parameters in monitored flocks in 2021, 2022, and 2023 (https://zchok.sk/) [28]

No	Year	Number of flocks	Ewes mated	Premature lambings	Barren ewes	Ewes lambed	Number of lambs	Ewes conceived	Fertility (%)	Prolificacy per ewe lambed
1	2021	35	6652	16	115	6521	8429	98,3	127,0	129,3
2	2022	42	8586	133	670	7783	10886	92,1	128,8	139,9
3	2023	43	9098	163	824	8111	11443	90,8	128,1	141,1

The average number of female animals per flock was 190.1 in 2021, increasing to 204.43 in 2022 and 211.58 in 2023. These figures indicate that the analysis was conducted on a substantial sample. Over the three-year period, a slight increase in average flock size, expressed as the number of female animals per flock, was observed. The number of animals per flock increased despite a modest rise in the total number of monitored flocks.

A marked difference was observed in the number of abortions, recorded as premature lambings, with a substantial increase over the study period. In 2021, only 16 ewes (0.24%) aborted, whereas this number increased sharply to 133 animals (1.54%) in 2022 and to 163 ewes (1.79%) in 2023.

In addition to this parameter, the number of barren ewes is also relevant. In 2021, 16 ewes (0.24%) were barren, compared with 133 animals (1.55%) in 2022 and 163 ewes (1.79%) in 2023.

When considered together, the numbers of barren ewes and ewes that aborted represent a substantial proportion of reproductively unproductive animals, thereby reducing the economic efficiency and profitability of production.

Könyves *et al*. (2011) [9] investigated milk production in Tsigai sheep raised in Vojvodina, Serbia. Their results showed that daily milk yield ranged from 0.46 to 0.88 kg. Over a six-month milking period, milk production may reach approximately 150 litres.

Milk production in Romanian Tsigai sheep was investigated by Ilisiu *et al*. (2013). Their findings indicated that milk yield ranged from 70 to 90 litres per lactation.

Oracova (2015) [20] reported that a total of 168,000 sheep were involved in milk production. The average milk yield of Tsigai sheep was approximately 110 kg. Data from the official breeding records service (https://zchok.sk/) [28] indicate that 6,203 Tsigai sheep were registered in Slovakia in 2015, representing only 3.7% of the total sheep population.

In 2018, sheep-milk production reached its highest level since Slovakia joined the European Union. Annual milk production amounted to 13,524 tonnes (https://www.mpsr.sk/spotreba-jahnaciny-pokrivkava-produkcia-ovcieho-mlieka-je-najvyssia-od-vstupu-do-eu/263---14356/) [29].

In 2019, the Tsigai population comprised 5,661 animals, whereas the total sheep population in Slovakia was approximately 340,000. Thus, Tsigai sheep accounted for only 1.67% of the national sheep population. An evident decline in the number of Tsigai sheep has therefore occurred. Although this trend is undoubtedly attributable to several factors, one of the principal reasons may be the breed's relatively modest milk yield. In comparison, certain specialised or improved breeds, such as the Improved Valachian sheep, may produce approximately 210 litres of milk per lactation.

Conclusion

The total sheep population in Slovakia has generally exhibited a continuous decline, with this trend being particularly pronounced in the Tsigai breed. This is best illustrated by the fact that, in 2019, the number of Tsigai sheep was 56.9% lower than in 2003, and the declining trend has continued. The most probable cause is the relatively low milk yield of the Tsigai compared with competing sheep breeds raised in Slovakia. Another contributing factor is the low consumption of sheep and lamb meat in the country. Consequently, milk production remains the primary production objective in Tsigai sheep farming.

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